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MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A most important contribution to the study of the origin of the crystalline schists has lately been made by Van Hise,[2] through the medium of the Bulletin of the recently organized Geological Society of America. It will be remembered that only a short time ago this writer[3] showed that certain mica-schists of the Penokee-Gogebic region in Wisconsin and Michigan are nothing less than sediments, in which secondary mineral changes have taken place. He now goes further, and shows that under the influence of pressure, and probably heat, the pre-Cambrian slates and conglomerates of the Black Hills, Dakota, have been changed into schistose rocks, among which are gneisses. The reasons given for this conclusion are: (1) The gradation of the slates into schists, with loss of slaty cleavage, and the development of a foliation, usually oblique to the cleavage, and sometimes even perpendicular to it; (2) the concentric arrangement of the schists around granitic areas in such a way that the strike of their foliation is always parallel to the boundaries of the eruptive rock, and the dip always inclined away from them; (3) the clear evidence afforded by the microscope to the effect that the rocks intermediate between the schists and slates have all suffered squeezing to such an extent that their various constituents, more particularly the quartz, have been flattened, cracked, and even broken, so that their different parts extinguish differently; and finally (4) the certainty that much of the material of the schists is of secondary origin. The new minerals produced by the forces at work are silica in different forms, biotite, muscovite, and feldspar, and sometimes hornblende, garnet, tourmaline, and staurolite. In the less schistose varieties the grains of the original slates can be distinguished, as they are outlined by a layer of ferrite deposited upon them before they had lost their characteristic shapes. The quartz grains are flattened in the direction of the line of supposed pressure, and are broken. The cracks are often filled with particles of iron oxides, and sometimes are marked by lines of fluid inclusions. The deposition of silica around the fractured quartz grains and the production of secondary mica and feldspar are regarded as abundantly able to change a slate into a schist, especially when foliation has been superinduced by pressure, with the aid of heat sufficient for the fusion of the original sediments. Attention is called to the fact that these schists are not members of the great complex underlying the earliest sedimentary rocks, but are contemporaneous with some of the latter which are probably of Huronian age.——After a very thorough discussion of fifty-three analyses of plutonic and effusive rocks Rosenbusch[4] concludes that the cause of the great variety in the rocks extruded from an eruptive center is the capacity of an original magma for separating into portions with different compositions (Spaltungsfähigkeit). These different portions may exist under the earth's crust in positions very near each other. From the very nature of the discussion, depending as it does upon so much detail, it is impossible to reproduce its argument in these pages. It must satisfy our present purposes to state that Prof. Rosenbusch thinks the original magma had a composition near that of a mixture of elæolite-syenite, peridotite and residues of the formulas $(NaK)AlSi_2$ and R_2Si. The residue $(NaK)AlSi_2$ possesses the capacity of taking up silica and yielding granite magma. The first splitting of the original magma yielded derivative magmas (theilmagmen), which have solidified as plutonic rocks. Further differentiation produced the materials whose solidification yielded the effusive rocks. This explanation of the differences existing in the composition of the plutonic rocks and their corresponding effusives is thought by Rosenbusch to be better than that which ascribes them to a separation of the original magma according to the density of its parts, whereby the highest portions (those producing the effusive rocks) had of necessity a different composition from the lower portions. The paper contains significant utterances with respect to the relations between the geological age of a rock and its structure. It is said that the difference between older and younger effusive rocks is "that the former have existed on the surface for a longer time than the latter, and consequently have suffered a series of changes (umbildenden Processen) . . . One needs no great gift of penetration to prophesy that in the near future this separation [of the paleovolcanic from the neovolcanic rocks] will lack recognition."——Dahms[5] has examined a set of hand-specimens brought from the Transvaal, Africa, among which he recognizes gabros containing pleochroic diallage and augite, the two minerals occurring in different parts of the same mass, and secondary quartz and hornblende. He finds also diabases and quartz-diabases, a quartz-porphyry in whose quartz-phenocrysts are inclusions of carbon-dioxide, augite-porphyrite, granite, and granitic and syenitic porphyries. Each of these rocks is described, and analyses of several of them and their constituents are given. The most interesting point brought out by the analyses has reference to the relation between the diallage of a gabbro and the secondary hornblende derived from it.

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. Geol. Soc. of Am., Vol. I., p. 203.

[3] AMERICAN NATURALIST, Aug. 1886, p. 723.

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[4] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 144.

[5] *Neues Jahrb. f. Min.*, etc., Beil. Bd., VII., 1890, p. 90.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	H_2O
Diall.	53.53	3.12	5.09	13.54	6.19	18.77	.57	.20	
Hornb.	52.73	4.70	5.26	10.21	12.58	12.59	.23	.06	1.54

An increase in CaO and decrease in MgO in passing from diallage to hornblende is in opposition to the view held in regard to the nature of the change. The author is compelled to look upon it as paramorphic. ——Cathrein[6] has re-examined the rock from Ehrwald in the Tyrol, called by Pichler augite-porphyry, and thought by Rosenbusch to belong possibly with the teschnites, and has found it to consist of phenocrysts of augite, both monoclinic and orthorhombic, in a ground-mass composed of crystals of biotite, pyroxene, hornblende, apatite, and magnetite, in a base containing some radially fibrous mineral in an isotropic substance. The rhombic-pyroxene has been changed to bastite, which is intergrown with biotite and augite, and is surrounded by small crystals of augite of the second generation, of hornblende, and of biotite. The augite of the ground-mass is grouped in aggregates resembling chondrites, and is pleochroic in violet and yellowish-red tints. The author classes the rock with the augitites, and calls it bastite-augitite or Ehrwaldite.——Spherulites composed of radiating bundles of an alkaline feldspar and spherical masses of tridymite occur in the obsidian of the Lipari Islands, according to Mr. Iddings.[7] They are similar to the spherulites and lithophysæ of the rock from Obsidian Cliff, and contain, like the latter, little honey-yellow crystals of fayalite.——In an appendix to an article by Mr. Barlow[8] on the contact of the Huronian and Laurentian rocks north of Lake Huron, Dr. Lawson briefly describes a few sections of quartzites on the contact with gneisses, in the former of which he believes are evidences of contact alteration, in which event the gneisses must be regarded as eruptive.——Mr. Fairbanks[9] has examined eighty sections of basic dykes from the north shore of Lake Huron, and has found them to be diabases, diorites, and alteration products of these.

[6] *Verh. d. k. k. geol. Reichsanst*, I., 1890, p. 1.

[7] Iddings and Penfield, *Amer. Jour. Sci.*, July, 1890, p. 75.

[8] *Am. Geologist*, July, 1890, p. 19.

[9] Ib., Sept., 1890, p. 162.

Mineralogical News.—In two very much decomposed rocks from Custer County, Colorado, Mr. Cross[10] has discovered an interesting series of secondary *hornblendes* and *pyroxenes*, whose study leads him to the view expressed by Williams, viz., that the most convenient way to place hornblende crystals in order to show their relations to pyroxene is with the orthodome in the position of the basal plane. One of the amphiboles described is a blue variety with the pleochroism of glaucophane. It is found in a rock composed of green pyroxene and small pieces of brown hornblende, imbedded in a matrix of quartz, calcite, and minute blue and green amphibole needles. It is an alteration product of the brown hornblende and the augite, from both of which it results either directly or through the interposition of actinolite. Both the latter mineral and the blue hornblende are also found as enlargements attached to the clinopinacoidal and terminal planes of the brown hornblende and the augite. The axis of greatest elasticity of the blue hornblende is inclined 13° to 15° to the vertical cleavage, and is on the same side of it as in the case of glaucophane, actinolite, etc., while in common hornblende it is on the opposite side, since the extinction angle is here the angle included between c and the axis of least elasticity. The optical angle of the blue amphibole is large, and the absorption is $A > B > C$. A second rock in which the mineral occurs is a conglomerate, in pebbles in which the same relations exist between the hornblendes as those mentioned. A second rare variety of amphibole discovered in these rocks is of a rich chestnut-brown color, and has an extinction of 8°. It is regarded as an added growth. An emerald-green secondary augite occurs in diorite pebbles in the conglomerate above mentioned. It is an alteration product of the blue hornblende and of an unknown yellow mineral. Its axis of greatest elasticity is but slightly inclined to c. Its pleochroism is strong in green and yellow tints, and its absorption as follows: $A > B > C$. Upon comparing the properties of these minerals with those of other members of the amphiboloid group Mr. Cross is inclined to regard the chestnut-brown hornblende as closely allied to *barkevicite*, while the blue variety is either *arfvedsonite* or *riebeckite*. The green augite is considered to be *ægerine* or *acmite*. Twelve diagrams exhibiting the relations of the axes of elasticity to the crystallographic axes of the different varieties of amphibole and pyroxene accompany the article. If the plane usually taken as the orthodome in hornblende and augite is made the basal plane, the relations shown by the diagrams are rendered quite simple; whereas if the usual orientation is accepted the relations are not apparent. The paper is important as affording strong argument for a change in the position of crystals of hornblende and augite, as also for the interesting announcement of the discovery of a secondary augite.——The parting of certain hornblende crystals from St. Lawrence County, N. Y., analogous to the basal parting of augite, has been found by Williams[11] to be the result of twinning along gliding planes parallel to the face usually regarded as the orthodome. Since the parting in augite takes place parallel to the basal plane, and since in parallel growths of hornblende and augite the parting in the two minerals is parallel, it is suggested that in both cases the plane parallel to which the parting takes place be taken as oP. The advantages of this new position lie in the correspondence between the morphological and optical properties of the two minerals.——Crystals of beautiful blue *celestite* are described by Williams[12] from the Helderberg Limestone in the western flank of Knobly Mountain, Mineral County, West Virginia. They occur in flattened lenticular pockets, partially or entirely filled with clay. The crystals, which are associated with gypsum and calcite, are found implanted on the walls of the cavities or imbedded in the clay. The celestite is pyramidal in habit in consequence of the predominence of the brachypinacoid $P\breve{4}$. In some crystals these faces occur alone, when the crystals are often rounded into lenticular bodies. Other forms observed are $\infty P\bar{\infty}$, $\frac{1}{2}P\bar{\infty}$, oP, $P\breve{\infty}$, and ∞P. oP is rough and drusy, and $\infty P\bar{\infty}$ is vertically striated. The optical angle is $2 V_{na} = 49° 54'$, and composition almost pure $SrSO_4$. The resemblance in habit between these celestites and thinolite,[13] and their similarity with the Sangerhausen pseudomorphs that have generally been referred to gaylussite, are striking.——Becke[14] has examined some highly modified *dolomite* crystals from the Binnenthal and from Scaleglia, and *magnesite* from the latter locality, and on the former has found some new rhombohedra. The dolomite from Scaleglia is marked by unsymmetrical etched figures that differ in shape from those artificially produced on this mineral. The magnesite is interesting, as it contains two orders of scalenohedra, the first forms of this kind found on the mineral. The hemihedral crystallization of calcite, siderite, and magnesite, and the tetratohedrism of dolomite are explained in accordance with the Sohncke-Wulff theory, by the fact that the latter's molecule comprises two metallic elements of different kinds, while in the former the metal is of but one kind. A full list of forms that have been discovered in dolomite is incorporated in the descriptive part of the paper.——Mr. Kemp[15] communicates a few notes on some peculiar *calcite* crystals, and also on tourmalines, sphenes, and magnetites that have been subjected to pressure. The magnetite is striated as a result of the pressure, which has produced a parting apparently parallel to O and ∞ O. The minerals were found in the vicinity of Port Henry and Mineville, N. Y. ——A new analysis of Cornwall *connellite* by Penfield[16] shows it to be analogous in composition to the new mineral spangolite. Its formula may be written $Cu_{15}(ClOH)_4SO_{16}+15H_2O$.——The hexagonal tables of *eisenglimmer* in the sunstone of Tvedestrand, and in the carnallite of Strassfurt are pleochroic, according to Rinne,[17] with $\omega > \varepsilon$. The colors are yellow and dark brown.——As the result of several analyses Jannettaz[18] concludes that oriental *turquoise* is colored by phosphate of copper, while the color of the occidental turquoise is of organic origin and due to phosphate of iron (vivianite).——The *titan-olivine* of Damour (from Pfunden, in the Tyrol), thought by Descloizeaux to be orthorhombic, has been examined optically by Lacroix,[19] and found to be monoclinic. Its thin section is pleochroic in yellowish and reddish-yellow tints. It is polysynthetically twinned, and its optical angle $2V=62° 18'$. It is, therefore, intermediate in character between olivine and the minerals of the humite group.——At the lower extremities of stalactites of *nesquehonite*[20] pseudomorphs after *lansfordite* from Lansford, Pa., Genth and Penfield[21] have discovered crystallographic planes which enable them to work out very satisfactorily the crystallization of the original mineral, which is found to be triclinic with $a:b:c = .5493:1:.5655$.——The similarity in properties between *agalite* from northern New York and bastite seems to indicate that the former mineral is an altered enstatite.[22]——Gürich[23] has recently published a list of the minerals occurring in the German possessions of Southwestern Africa. The list embraces about fifty-five species, and these are separated into groups, according as they occur

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[10] *Amer. Jour. Sci.*, May, 1890, p. 359.

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[11] *Am. Jour. Sci.*, May, 1890, p. 352.

[12] Ib., March, 1890, p. 183.

[13] Dana. Bull. U. S. Geol. Survey, No. 12, 1884.

[14] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 223.

[15] *Amer. Jour. Sci.*, July, 1890, p. 62.

[16] Ib., July, 1890, p. 83.

[17] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 193.

[18] Bull. Soc. Fran. d. Min., 1890, p. 106.

[19] Ib., XIII., 1890, p. 15.

[20] AMERICAN NATURALIST, April, 1889, p. 261.

[21] *Am. Jour. Sci.*, Feb., 1890, p. 128.

[22] Scheibe. *Zeits. d. Deutsch. Geol. Ges.*, 1890, XLI., p. 564.

[23] *Neues Jahrb. f. Min.*, 1890, I., p. 103.

in pegmatite or in quartz veins, in quartz lenses in schists, or imbedded in granite, mica-schist, hornblende rocks, crystallized limestones, or garnetiferous beds.——Oebbecke[24] describes briefly a small crystal of *arsenopyrite* from the granular limestone of Wunsiedel, in the Fichtelgebirge. Its composition is: As = 46.91 ; S. = 18.64; Fe = 34.31. ——Mr. Diller[25] announces the discovery of native *gold* in calcite from near Minersville, Trinity Co., Cal., and Mr. Hersey[26] mentions the discovery of *arsenic* in nodular masses in a silver and gold mine a few miles west of Leadville, Colorado.——*Magnetite* crystals from serpentine in New Zealand are reported by Prof. Chester[27] to have the composition following:

Fe_2O_3	FeO	Mn_3O_4	MgO	CaO	SiO_2
66.71	19.62	4.63	7.15	tr.	2.38

The silica is supposed to come from particles of silica adhering to the crystals.——Lacroix[28] believes that *carphosiderite* is a much more common mineral than is generally supposed.

Mineral Syntheses.—By an interesting series of experiments, that are in the main but modifications of well-known processes, Weinschenck[29] has prepared metallic sulphides with many of the properties of the natural compounds. By distillation of the oxides with salammoniac and sulphur he obtained crystals of pyrite and of a regular copper sulphide with the composition of chalcocite. By the action of sulphuretted hydrogen under pressure upon the proper salts, galena, argentite, covellite, cinnabar, orpiment, troilite, millerite, and alabandite were produced. Corundum, diaspore, and rhodochrosite were obtained by the action of urea upon suitable compounds in solution. Other experiments afford an insight into the method of formation of the minerals of the apatite group. The paper is a valuable contribution to the study of the genesis of some of the most important of the common minerals.——Messrs. Hautefeuille and Perry[30] have dissolved alumina in nepheline, and have gotten a vitreous paste in which are many hexagonal plates of corundum.——Michel[31] has produced azurite and gerhardite by allowing a solution of nitrate of copper to act on particles of calcite several years under the ordinary pressure. ——Nepheline, leucite and orthoclase have been obtained by Messrs. C. and G. Friedel[32] upon treating finely-powdered muscovite with alkalies and alkaline silicates in various proportions. With potash containing about two per cent. of soda a portion of the muscovite is dissolved, and prismatic hexagonal crystals of nepheline are yielded. The composition of these shows them to consist of a mixture of one part of potash nepheline to two parts of the corresponding sodium compound. When soda is substituted for potash the nepheline crystals produced measure 5—8 mm. in length, and consist of one part potash nepheline to three parts of the sodium compound. When treated with silicate of potash and heated, beautiful crystals of orthoclase are produced. Leucite, together with orthoclase and nepheline, are yielded by a mixture of mica with half its weight of calcined silica and seven-tenths of its weight of potash. The same experimenters[33] produced anorthite by treating mica at 500° with lime in the presence of water. Having obtained sodalite[34] by the action of soda and sodium chloride in mica, they next attempted to make nosean by substituting the sulphate for the chloride in the last experiment, but succeeded[35] only in the production of prismatic negatively uniaxial crystals differing from nosean in containing two molecules of water.——Nitrate of copper heated to 130° in sealed tubes with urea yields[36] a basic nitrate identical with gerhardite.[37]

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[24] *Zeits. f. Kryst.*, etc., XVII., 1890, p. 384.

[25] *Am. Jour. Sci.*, Feb., 1890, p. 160.

[26] Ib., p. 161.

[27] *Min. Mag.*, 1889, VIII., p. 125.

[28] Bull. Soc. Franc. d. Min., Jan., 1890, p. 8.

[29] *Zeits. f. Kryst.*, XVII., 1890, p. 486.

[30] Bull. Soc. Franc. d. Min., 1890, XIII., p. 147.

[31] Ib., p. 139.

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[32] Ib., p. 129.

[33] Ib., XIII., p. 233.

[34] Ib., XIII., p. 183.

[35] Ib., XIII., p. 238.

[36] Mallard. Ib., p. 67. Cf. Ref. to Michel's Syntheses above.

[37] Wells and Penfield. *Amer. Jour. Sci.*, 1885, XXX., p. 50.